Whatever operation be selected, if it be conducted near the seat of the disease, the surgeon should be prepared to encounter considerable hemorrhage. Thus in cases I. and VI. of the excisions, not less than forty ligatures were required, while in the case of Professor Gross (see p. 41) of disarticulation at the shoulder, the loss of blood was so great, despite compression of the subclavian artery, that death ensued in two hours.

ARTICLE II.

THE SUDDEN DEAFNESS OF SYPHILIS, WITH CASES.

BY SAMUEL SEXTON, M.D., Surgeon to the New York Ear Dispensary, Aural Surgeon to the New York Eye and Ear Infirmary.

WRITERS on aural affections have long known that invasions of the ear by syphilis were not of uncommon occurrence, and the prevailing opinion has been that the seat of the lesion is usually in the labyrinth. Better knowledge of the disease, however, seems to lead to the conclusion that its chief, if not entire, location is in the middle ear and its conductive mechanism. At the beginning of this century, especially in England and France, there was a sudden increase in otological literature,[1] if it deserves that name, and the references to "constitutional deafness," which included aural affections, having their origin in syphilis, are frequent.

Mr. Saunders,[2] whose work in 1806 fairly represented the then existing views on this subject, says (page 95, *et seq.*), "The whole class of the diseases to which the internal part of the ear is subject may be denominated nervous deafness," and after describing the distressing and peculiar tinnitus which characterizes "nervous deafness," he goes on to say, "Being forcibly struck with the congruity between deafness produced by syphilis, and the concomitant symptoms of nervous deafness, I could not avoid concluding, that although the remote cause be different, the proximate cause is the same in each," and "When the syphilis is cured, the effect is often irremovable, and the injury to the function of the affected organ permanent. There is a period, therefore, at which syphilitic deafness is irremediable, and this is more remarkably the case with nervous deafness." Saunders having satisfied himself that the proximate cause of syphilis and nervous deafness was the same, determined to try the success of an analogous treatment in a recent case of "nervous deafness." The patient selected was J. Waiton, who applied to Mr. Saunders at the Dispensary for relief. "He had been extremely deaf for two months. The meatus contained little wax, and he could inflate the tympanum. He complained of noises in the head, such as I have described above. His deafness was so great that I could scarcely make him hear what I said. He was a robust man, and plethoric. I put him on a most rigid diet, and gave active cathartics three times a week. For the first fortnight the doses were calomel gr. viii at night, and natron vitriolat. ℥iss in the morning. Blisters were also applied behind the ears three times successively at intervals of a week. He continued on this plan for six weeks, the cathartics being regulated according to circumstances. His hearing was now restored, but slight noises still remained. He was much reduced, and I gave him small doses of calomel every night, and sarsaparilla twice a day for a fortnight. The noises had now left him, he was put on his usual diet, and took cinchona. At the end of ten weeks he was perfectly well."

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[1] Vide Works of Saunders, London, 1806; Curtis, London, 1819; Wright, London, 1829; Caswell, London, 1833, and Itard, Paris, 1821; Deleau, Paris, 1822; Saissy, Paris, 1827, etc. etc.

[2] Treatise on the Ear, first American edition, Phila. 1821.

Mr. Saunders reports other cases in which in his own hands the above treatment was successful, but he fails to inform the reader if any of them had syphilis, an unimportant fact surely with the accepted nomenclature of that day. Mr. Saunders regarded the immediate cause of the deafness to be the deposition of lymph, and in the incipient state he proposed to attack the disease by a "strict antiphlogistic treatment," and the resort to means for promoting absorption. This was the period which immediately preceded the day of Joseph Toynbee, when the foundation was laid for a more exact pathology.

The English aurists[1] of the period subsequent to those above mentioned almost entirely omitted syphilitic affections of the ear from their writings, as did also the continental writers, unless, indeed, an exception be made of the researches of Frank and Linke, who, however, confined themselves mostly to the description of external syphilitic lesions.

It remained for Sir William Wilde to more nearly approach a solution of the syphilitic affections of the tympanum which this paper is intended to describe than had any one else previously. Although Wilde treats of the subject under the head of *syphilitic myringitis*, he evidently describes the disease as it affected the tympanum and its conductive mechanism. He says :—[2]

> "Although practitioners who treat syphilitic diseases upon a large scale appear to be aware of the fact that venereal occasionally causes deafness, I cannot find any authority which has noticed the disease I am about to describe. The deafness which sometimes accompanies the secondary form of syphilis is generally believed to be caused by inflammation, and ulceration extending from the throat through the Eustachian trumpet into the middle ear; such may, under certain circumstances, no doubt, occur, and produce destructive inflammation and suppuration in this cavity, although I have never seen such a case myself, nor have I met with a well authenticated instance of it recorded. . . . The disease which I am

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[1] Pilcher, Dufton, Harvey, Toynbee, Yearsley, etc.

[2] Practical Observations on Aural Surgery, by William R. Wilde, Phila. 1853, pp. 252, et seq.

about to describe is an inflammation of a specific character, occurring in the membranes of the tympanal cavity, but chiefly exhibited in the external membrane of the drum. All the cases I have seen of this affection occurred in young men, and generally those of fair complexions and blue eyes, who had had primary sores upon the genitals from six to twelve months previously, which sores were of rather a deceptive character, so that mercury was seldom given in the first instances, at least in a legitimate form."

In these cases there were generally well marked secondary affections, and—

"In almost every case which I have witnessed, the *disease appeared suddenly*, as an eruption was fading off; in two, it came on at a later period, and was accompanied by a loss of hair; in most it appeared in the upper or middle ranks of life. In most cases there is at first a sensation of fulness in the head, and often vertigo upon stooping or rising up suddenly, and the patients have usually a feeling of fulness within the ear; but in no instance have I seen it accompanied by acute pain, in which circumstances it resembles the subacute form of inflammation already described, and is therefore placed as a subdivision of that species; but upon inspection, the amount of redness and vascularity will be found very much greater than the latter; . . . . *both ears are usually attacked at the same time.*"

"*The amount of deafness is always very great*, and is the symptom that first attracts the patient's attention, and it seldom varies. Tinnitus is not usually present, but in two cases which I possess the notes of, the deafness was ushered in by a very loud noise, which passes away after a few days. *This inflammation does not end in a muco-purulent discharge from the tympanum, the surface of the membrana tympani, or the sides of the auditory canal.*[1] . . . Two of the worst cases of non-congenital deafness I ever saw appeared to have been the result of syphilitic inflammation, and in both there was great thickening, opacity, and insensibility of the membrane. I am also inclined to think that syphilis has played a more extensive part in the production of deafness than the profession is aware of."

It will be observed that Wilde regarded the disease as an affection of the membrana tympani only, but his description comes very near reaching the disease as it is now believed to exist in the middle ear. That he did not find tinnitus in all of his cases may be accounted for by supposing that in some instances an error in diagnosis was made. Wilde reports several cases that were cured with mercury pushed to salivation.

Writers, since the time of Wilde, have not added much to his pathology of this subject; the majority of them, in fact, have sought for an explanation of some of the prominent symptoms of the disease by locating the lesions in the labyrinth. Schwartze,[2] who has written exhaustively on aural pathology, omits any account of special syphilitic lesions, although he includes in his work croupous and diphtheritic inflammations. Schwartze's researches, however, throw us into a state of doubt as to our knowledge of the pathological physiology of the labyrinth when he informs us that so little is known regarding its pathological histology. He says:—[3]

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[1] The italics are ours.

[2] The Pathological Anatomy of the Ear. Schwartze. Translated by J. Orne Green. Boston, 1878.

[3] Loc. cit.

"The pathological histology of the labyrinth of the ear is still in the first stages of its development, and needs the services of an extraordinary anatomist, who must work deeply and thoroughly in this most difficult field for years to bring forth any result. What has been done by some in this field, of late years, with the most earnest endeavors, is scarcely more than a sad dillitanteism, and has no value for science."

A step forward has certainly been taken in removing from the list of nervous affections of the labyrinth diseases whose symptoms now clearly establish their identity with anomalies of the conductive apparatus of the middle ear. Of the primary and secondary diseases of the acoustic nerve, or of the labyrinth and its bony case, we know but little, and can, therefore, place but little value on observations made with the belief that such knowledge exists. "Even in the most acute inflammations of the tympanum, a simultaneous hyperæmia of the labyrinth is met with only exceptionally," "and the existence of an independent and primary non-traumatic inflammation of the membranous labyrinth has not yet been demonstrated anatomically with certainty."[1] And it may be added that the temporal bone is not regarded as a favorite seat of such syphilitic affections as exostosis and the like.

The attacks of syphilis described by Wilde have many symptoms which also characterize sub-acute (non-purulent) mucous catarrhal inflammation of the middle ear, and I believe the specific character is frequently engrafted upon the catarrh. The ordinary catarrhal inflammation, however, is never attended by pathological conditions of the middle ear, causing the sudden and absolute deafness which attends on syphilis. The frequency of this affection is, I am sure, much greater than generally supposed, the greater number of such cases having been, in my own former experience, placed under the head of labyrinthian diseases.[2] When we consider that scarcely any part of the body escapes the ravages of syphilis, it is no matter of surprise that the ear is frequently invaded; in fact, an ear highly hyperæmic from any cause would seem to invite the disease to a region extensively supplied with a mucous membrane, and not without connective tissue, both of which structures are obnoxious to syphilis. The middle ear is probably but seldom invaded by syphilis *per* the Eustachian tube by extension from the mouth, throat, etc., the attack more frequently having its origin in the ear itself. The following cases are selected from my note-books as examples of this disease.

CASE I.—A German, aged 42, salesman, first seen by me December 29, 1877. On May 8, 1877, he became an inmate of St. Francis Hospital, from the records of which I learn that he gave a history of syphilis extending back two years before his admission. He had long been intemperate, and was much run down. Three months before his admission, he was weak and dizzy and staggering from side to side when walking, and he suffered from occipital headache, which gradually extended over the whole head. He had Bell's paralysis on left side of face. On admission the pain in head was intense, the paralysis of face still existed, and he was very anæmic and feverish. The prominent symptom now observed was hemicrania, first in left side of head, later in right side; finally both sides were the seat of intense suffering. Potassium iodide was given him in doses as high as 80 grains daily, with no relief. Bromide of potassium was substituted and afforded some relief. The paralysis now existed on both sides.

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[1] Loc. cit., page 157.

[2] Nottingham relates a case, but is unable to decide whether the disease should be located in the middle ear or in the labyrinth. In this case a mercurial course, and another of iodide of potassium, did no good. Diseases of the Ear. Nottingham. London, 1858.

August 1. Headache has been a little relieved, but deafness became a feature in both ears, and afterwards tinnitus, "like the wind in motion," was experienced, it being greatest in the left ear. No loss of sensibility or muscular contraction; soft palate drawn to left side; motor paralysis of right side of face diminished. Cannot hear shouting.

September 5. Discharged. During the last two months of his stay, he took biniodide of mercury and iodide of potassium. A brain tumour was supposed to be the cause of these symptoms. He now came to the New York Ear Dispensary (December 29, 1877), and an examination showed the right membrane to be very dull, somewhat congested at the anterior superior quadrant, and along the malleus plexus. It was greatly retracted. The left membrane was similar to the right, but there was a faint cone of light.

A vibrating tuning fork placed on teeth heard best in right ear; on vertex and glabella not heard. It is heard when held near either ear, and when on left mastoid. Vision at no time affected. His appetite is now good, but he has a dull, heavy look, and cannot close the left eye. He speaks as though his mouth was full of some fluid—the uvula drawn to right side. Eustachian tubes are open. His general health is fair, although there is yet much unsteadiness in his gait, for which he requires the use of a cane. When standing with closed eyes he feels "trembly," and if he attempts to walk he staggers, and has to exert himself to keep from falling. He was placed on biniodide of mercury $\frac{1}{25}$ gr. three times per diem.

January 9, 1878. Much better; walks without cane. When trying valsalva, cannot keep lips closed without holding them with his fingers. Perforated right membrane to-day in its anterior segment; no fluid in drum; but air passed readily on valsalva. There was no change in the hearing. Treatment continued.

February 3. Is getting stronger daily, and has less tinnitus. Fancies he can distinguish very loud noises slightly. Walks much better, and has been engaged at work as a street vender. Vision good. To cease treatment.

18*th*. Sounds like a drum or a church bell faintly heard. Finds cane only necessary at night. Cannot close his eyelids. There exists no pain. The membrane is clearing, although the anterior superior quadrant is somewhat thickened and injected. The right membrane resembles the left. His hearing for voice is not improved; indeed, he cannot hear any voice, however loud. The patient came no more.

CASE II.—A laborer, aged 21, was first seen by me January 11, 1878. Six months ago had a sore on penis, shortly followed by an eruption on the chest, and then on the legs. In five months after the sore appeared he awoke one morning and discovered that he was very deaf, and in a few days he could hear nothing. Having been exposed at out-door labour, he believed the deafness to be due to "cold." Three days later he experienced great pain in the occiput, extending down the neck, which was swollen, and so remained three weeks, during which time he was dizzy and unable to walk straight. There was dimness of vision. Simultaneously with the pain referred to, he experienced tinnitus in both ears which was like machinery in motion, sounding bells, etc. The tinnitus now is " like the wind."

Both *meatus*, which were large, contained a thin tenacious coating, which was dark in colour from the presence of dirt and cerumen, and remained attached to the integument of the meatus after syringing. The tympanic membranes were not well seen on account of the presence of this closely adherent substance on their external surface. The right membrane was dull, lustreless, of a pale white colour, and moderately retracted. The left membrane has a similar appearance, but is greatly retracted, and the irregular depressions create a suspicion that adhesions or agglutinations threaten.

Words shouted through a trumpet into left ear are unheard, but he fancies he can hear some sounds when the experiment is made in the right ear. A vibrating tuning-fork is heard when placed in the cranial bones. He has some slight throat trouble, and the Eustachian tubes are open. Rarefaction of air in both *meatus* enables him to hear some few words through a speaking tube. He was put upon an active, mercurial course.

16*th*. Has a severe cough, and pain in the forehead, and when walking he is dizzy and staggers like a drunken man. If the eyes are closed, the staggering from side to side is greater, and the experiment increases the headache and dizziness.

19*th*. The left membrane is less retracted, and compression of air in the meatus improved the hearing on that side so much that he could hear a sentence loudly spoken through trumpet.

30*th*. Dizziness continues to exist, also the frontal headache, which sometimes extends to one side of the head. There is much tinnitus in the left ear.

Feb. 2. Patient seems to be improving, and there is less tinnitus. The membranes are gently moved inward and outward by condensation and rarefaction of the air in the meatus. Medicine is still continued.

9*th*. There is scarcely any tinnitus in the right ear, and in the left ear it is greatly lessened. He hears the vibrations of a small bell which is damped by being held in the hand while it is ringing, twenty inches from right ear and one inch from the left. His general health is improving, although he has some sweating at nights. The doses of the medicine are lessened one-third.

13*th*. The left membrane is retracted at the anterior superior quadrant, and lies so closely to the posterior wall of the tympanum that the point of adhesion resembles a perforation. The tough substance in both ears has been softened by dropping in water containing twenty per cent. of glycerine, and syringing to-day removed the most of it. It has but little resemblance to cerumen. The right membrane can be seen to be clearing up, the left is very dull, especially the anterior segment. His hearing is a little better.

23*d*. The posterior segment of the left membrane is adherent, and the short process protrudes prominently, but the handle is not well outlined. Rarefaction by syringe does not remove the membrane from its position on the posterior tympanic wall, even when force sufficient to occasion slight bleeding is used. The whole membrane is gradually becoming adherent, but no active inflammation is apparent.

March 2. The right membrane is still clearing, and the left has become less adherent since last operation. There is free admission of air to both drums, which the patient is requested to renew by the occasional practice of Valsalva's experiment. There is less tinnitus and better hearing for bells, etc., in right ear.

9th. Left membrane is very irregularly retracted, and at anterior superior quadrant there is a hyperæmic condition. Patient now experiences very little dizziness. In both ears he has tinnitus.

23d. The right membrane is clear anteriorly, but about short process and extending down malleus handle there is a more less hyperæmic condition. In the left ear there is less tinnitus and better hearing.

April 20. Right membrane but slightly retracted and almost clear, except a small portion of the posterior segment, and there is a distinct cone of light. The left membrane is clearing also, but it is much sunken in places. He hears tuning-fork as before, and the Eustachian tubes are free. His hearing altogether is about the same that it has been for some time, *i. e.*, he cannot hear any words distinctly, however loudly shouted through a trumpet. There is no injurious effect of mercury observable. Patient did not again return. The temporary increase of the acuity of hearing by rarefaction and condensation is noticeable in this case.

CASE III.—Patient about three-fourths African, age 30. She first came under my observation at the New York Eye and Ear Infirmary on August 29, 1878. She stated that she had been deaf for seven months, and she thought it originated from a cold. On examination she is found to be absolutely deaf to all external vocal sounds, and is not aware of being able to hear anything. The deafness came on by degrees in a rather brief period of time. Before she was entirely deaf the rattling of dishes, when washed, sounded painfully loud, as though they were being broken. She describes the tinnitus at the commencement of the attack as resembling the humming of bees, but at the present time there is a roaring, which seems to "jar" her. She sleeps badly, one cause of which is, besides her general anæmic state, the alarm occasioned by the noises heard in her head. The symptoms of syphilis are, that some six months ago she had an eruption, sore throat, and falling of the hair, together with rheumatism. There are now glandular swellings on the neck below the mastoids and on the back of the neck. There are also some old cicatrices on the neck. A vibrating tuning-fork is heard when placed on the teeth.

The right tympanic membrane has a thickened appearance, and is moderately dull, a faint cone of light only being observed. The plane of the membrane is about normal. The left membrane presented about the same appearances.

The *meatus* are at their entrance large and oval, but towards the membrane their calibre is smaller and slightly denuded of epidermis. She is subject to occasional attacks of dizziness, and when she attempts to stand with closed eyes and feet placed together she falls backwards, nor can she walk with her eyes shut without a similar result. She describes a sensation, experienced sometimes when walking, as though she were being lifted up by springs underneath her feet. For the most part she hears her own voice when talking, but sometimes it suddenly becomes inaudible, or partially so, and then she is unable to regulate the pitch. At such times she unexpectedly elevates or lowers her voice, regulating it by its sound as heard by herself, a proceeding that embarrasses her very much, and also astonishes her auditor.

To-day while undergoing examination she could not hear herself scream. Later, when hearing better, she is requested to utter the letters of the alphabet, and she hears A best of all, and U and W pretty well. Consonants are not so well heard. While the examination is proceeding there is an exacerbation of the noises in her "ears and head" (probably from the excitement), and she cannot distinguish her own voice when talking.

To ascertain whether the drums contained any fluid I decided to make a perforation in one of the drum membranes, which operation was accomplished by pushing a chisel-shaped myringotome through the posterior segment of the left. No fluid was present in the tympanum opened, and I did not operate on the right side.

Sept. 2. The perforation made in the left membrane has healed, and the only result which immediately followed the operation was an increase of the noises heard for a short period of time. She is to take potas. iod. gr. iv every four hours.

5th. She is less dizzy, and can stand better with her eyes closed and feet together than before. She can hear her own voice most of the time, and it sounds "distant." Hears vibrating tuning-fork on chin and in left ear when placed on left mastoid. There is some tenderness in ears, which may be the result of so much handling.

April 9, 1879. The patient, not having been much encouraged as to the prognosis of her case as regarded her hearing, placed herself under the care of a gentleman connected with a charitable institution, and he, having also diagnosed syphilis ("cerebral syphilis"), gave her iodide of potassium in large doses. "During the treatment," he says, "she had several epileptiform seizures, some of them accompanied by eclampsia, others appeared to be '*petit mal.*'" He thought she was improved by treatment. The patient, who came to me again to-day, says she was in the institution referred to above for about four months, that while there under treatment she was weak, restless, and nervous. Some glands beneath right ear suppurated twice, etc. An examination to-day of the right membrane shows that its mucous coat is hyperæmic, as well as the border of the external layer where it joins the integument of the meatus externus. There is slight retraction of the membrane, and the cone of light is fairly well marked. The left membrane does not differ much from the above. She now experiences buzzing and roaring noises in her ears, with occasional sounds like the discharge of guns. Usually she hears her own voice in its natural tone, but it is, however, subject to changes to "hoarse or distant." She hears herself sing but not whistle. The vibrating tuning-fork is heard on teeth and mastoids but not on vertex. She is absolutely deaf as to the voice of others, but has learned to comprehend remarkably well by reading the lips. She can hear my voice when I speak through the mouth trumpet with its small end placed far back in her mouth, but cannot understand anything said.

CASE IV.—An Englishman, aged 21, consulted me September 14, 1878. His hearing was always good until two years ago (1876) when he was taken violently ill, and had vomiting and dizziness, with sudden and absolute deafness in his left ear, which he describes as coming on like a pistol shot, but without the presence of other noises. Immediately preceding this attack he was operated on for some affection of the eyes. At that time iodide of potassium was administered. This was in London, and shortly afterwards he returned to America. During the past summer (1878) he was in poor health, and on the night of July 21, he became dizzy after going to bed, and experienced a cracking noise in both ears; (perhaps both ears were invaded alike). In the morning he awoke with retching, and found that he was absolutely deaf in the right ear as well as in the left. He has experienced a great many indescribable noises in both ears ever since. At the present time the noises in the right ear are like the singing of a "Virginia mocking bird" and the ringing of bells. He is now anæmic and much run down, and requires the presence of an attendant when on the street. He has a great deal of vertigo, objects seeming to go around and up and down. If he stands with his feet together and closes his eyes, he at once falls to the right, and on attempting to walk he staggers about like a very drunken man. Since his disease began, over two years ago, he has suffered greatly from frontal headaches, the pain extending to the vertex. Of late these attacks are more severe. His tongue is clean, the pulse 80 and regular. His mother and an aunt are very deaf, and an uncle died of consumption. He himself seems to be a subject for catarrhal inflammation. For some years as he states, he has been subject to seminal emissions which have given him considerable concern. Although he does not admit having had syphilis, he has had attacks of sore throat, and is not at all frank in his manner when questioned on this point.

The *meatus* now contain a tenacious substance, which is light coloured. and is intermixed with some cerumen, preventing a view of the membranes. Most of it being removed by syringing, the right membrane was found to be coated by an ashy-white humid exudation, and the left membrane was white in colour and lustreless, the malleus handle being quite red. The patient informs me that formerly his face was highly flushed much of the time. The skin of the auricles and mastoids is hyperæmic. With the second dentition he had much toothache, and now he has just cut the two upper wisdom teeth, their direction being rather outward. The inferior wisdom teeth have yet to appear. He has one carious tooth which is ragged, and his throat is slightly catarrhal.

He hears his own voice distinctly, the distinctness, however, frequently varying for a few moments at a time, which the observer can detect as he elevates or depresses his voice to correspond with his own estimate of its proper pitch.

He hears absolutely no outside voice in the left ear, but in the right ear he can hear sound when I strike the metal bougie on a tuning-fork held close to the ear. The vibrating tuning fork is heard on either mastoid, and on the teeth. When the external *meatus* are closed by pressing the tragus against the meatus by the fingers, the voice of the patient and the tuning fork on the cranial bones are heard more loudly. His voice to himself sounds like a voice coming from down in a well. When he screams or speaks very loudly, the sounds have to him a metallic quality like striking together two pieces of metal, and my own voice carried to his ears by trumpet has same character. His ordinary voice heard through conduction of tissues from his vocal chords to his ears is muffled. Very low tones of little intensity uttered close to his ears are very painful. He is given hydrobromic acid.

21*st.* The left membrane is observed to be greatly retracted, and there is a state of hyperæmia at its anterior superior quadrant extending on to the meatus externus; the inner extremity of the latter is also narrowed by its swollen integument, and it is tender.

Looking into the right ear, it is found that the inner extremity of the meatus is hyperæmic, and disposed to bleed when touched by the speculum, the membrane still coated by a sort of exudation which has been softened by the application of a weak solution of glycerine in water. After its removal by syringing it is found to be a good sized mass, which looks like exfoliated epidermis. The membrane is now free to inspection.

Patient has better general health but the cough is still harassing; the dizziness is less. The patient's condition now being favourable, I decided to begin with one-fiftieth of a grain of the red iodide of mercury, to be taken three times a day shortly after eating. The hydrobromic acid which had a good effect now to be used only when required.

23d. Patient fancies he can hear the singing of a canary bird more distinctly, as well as the sounds of ringing bells, rattling of dishes, and the voices of children, etc. Of these fancied improvements I entertain some doubt, as the patient is hopeful of cure, and does not doubt for a moment that he will ultimately recover his hearing. If the gravity of his disease were fully realized, it was believed by myself and his friends that he would commit suicide.

To-day I examine his hearing power by the highest and lowest tones of my own voice. Both are to him painfully high in pitch, as he himself states it, "so high that he cannot hear it." Bells have a cracked sound, and there is a vibratory, metallic quality to all sounds heard. When I speak to him through a mouth trumpet—a tube of two and a half centimetres in diameter, fitted with suitable tips of vulcanite, and when in use extending from observer's mouth into that of the patient—he hears my speech of both high and low tone, but it all seems to him "low and rumbling, or gruff." The tinnitus in left ear is constant; in the right ear it is variable. The condition of the membrane is about the same.

30th. Patient still complains of "weakness of the knees and ankles," but his cough is better. He says he heard voices in the horse-car this morning, and he hears a vibrating tuning-fork held near the right ear. Treatment continued.

Oct. 5. Patient gains in strength. Dr. A. H. Buck, who now saw the patient, agreed with me that the mercury should be pushed, and he was accordingly given—℞. Hydg. bichlor., gr. j; Potas. iod. ℥ss; Syr. sarsaparilla co., ℥iv. M. A teaspoonful three times a day, together with mercurial inunctions.

7th. The inunctions continued, but the mixture stopped, and tablets containing one-fiftieth of a grain of iodide of mercury resumed.

12th. Treatment continued, although the stomach is slightly disturbed by colic, and he experiences some sweating of nights. In both ears there is a feeling like the presence of fluids, and he has some vertigo.

15th. The noises are observed to increase by exercise; they are like "blood sent to the head." Patient's general health improving, and he hears more sounds from without, but they seem abnormally high in pitch. On piano all the notes are heard up to middle C; after that he only distinguishes a rumbling sound. He has ascertained that he can tell whether he is singing high or low. When I speak loudly in his ears, it is heard as high, and a hissing noise sounds like whistling. The experiments, when repeated through the mouth trumpet, seem to be heard normally. All the sounds heard through mouth are distinguished, he believes, by the right ear. In the left ear the loudest sounds feel like "something being poked into the ear," and not as sound usually is heard. There is tinnitus at times like cracking, and when he is quiet whistling is heard. Patient frequently speaks of hearing a rushing of blood. His general health is improving.

24th–28th. The mercurials were pushed more actively.

Nov. 21. The treatment was uninterruptedly maintained until the present, when the patient is compelled to cut short his stay in New York. There was no decidedly constitutional effect from the medicine. His hearing was only slightly modified during his treatment, and when he left he could hear no conversation, even through a trumpet. His general health, however, was greatly improved.

It should be stated that in none of these four cases were the throat symptoms very prominent, nor were the Eustachian tubes found to be obstructed in any of them. In fact, from all that I can glean from the literature of this subject, and from my own observations, I incline strongly to the opinion that syphilitic lesions seldom, if ever, reach the middle ear by continuity of tissue from the throat.

That these cases were syphilitic, I feel quite sure; for, besides the history of the cases, we know of no cause which produces such peculiar and decided symptoms of deafness. For some of the recent literature bearing on the history of such cases, we need go no further than the authors of America.[1]

These affections are seldom suppurative, although in all of my cases there was a history of considerable hyperæmia of the middle ear, which also showed itself in the integument of the external auditory canal. There is a point of interest in these cases to which, as far as I know, attention has not yet been drawn by writers on this subject. I allude to the pre-existing state of hyperæmia in the drums, either from cold or from a sympathetic irritation associated with some affection of the mouth or throat, thus inviting, as it were, an invasion of the drum by the specific affection, an example of which is seen in Case IV., where there was not only a decided catarrhal habit, but the irruption of the wisdom teeth is superadded. As regards the behaviour of syphilitic inflammation in a closed cavity like the tympanum, we know that the result is most destructive to normal hearing, although not suppurative, and that the destructive process probably consists in an exudation, or the deposition of new plastic material, that interferes with the normal functions of the conductive apparatus. The retraction of the membrane seems to depend on causes other than the absence of free Eustachian tubes.

There would appear to be a contraction of the mucous lining of the drum, the membrane under these circumstances having a wrinkled appearance. The labyrinth in these cases seems not to be greatly involved, for the auditory nerve responds fully to the sounds conveyed to it, whether from the patient's own vocal chords, etc., or the vibrating tuning-fork placed on the skull. That the immobility of the membrana tympani and the pathological condition of the chain of ossicles (separating the malleo-incudal or stapedo-incudal joints, or fixation of the stapes in the oval window) are sufficient to account for all the phenomena of audition as described in the four cases above cited, I have no doubt. The slight changes in this apparatus, capable of deranging audition, may be better appreciated when it is remembered that the range of the excursions occasioned by sound waves is from 16 to 45,000 per second. The attention of the reader is drawn to the progressive changes in the appearance of the membrane observable in some of the cases above reported. The deafness in these cases is not always sudden, nor do both ears always become affected simultaneously, although I am inclined to believe this is the rule. My own explanation of these anomalies has been attempted elsewhere.[1]

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[1] Those interested in the literature of this subject can consult a paper by Dr. Knapp, entitled "A Clinical Analysis of the Inflammatory Affections of the Inner Ear," Archives of Oph. and Otology, vol. ii. 1871; Dr. Roosa's "Treatise on the Ear," 4th edition, page 485; Burnett's "Treatise on the Ear," 1877, page 568; Dr. Albert H. Buck, "Syphilitic Diseases of the Ear," American Journal of Otology, January, 1879.

That the labyrinth or any portion thereof, as the cochlea, may fail in the performance of its functions may be sometimes the case, but in the class of which those cited in this paper are examples, the writer considers such an explanation as improbable.

There is one striking phenomenon observed in nearly all the cases I have seen, namely, the high pitch, if I may so designate the condition, of all sounds heard under certain conditions. I have observed this symptom in acute inflammations of the middle ear, and I believe it must have often been noted by other otologists, but perhaps described by them as relating to "false" or "double" hearing. The latter, however, is simply a condition of autophony, while the "high pitch" of sounds heard seems to depend on some physical anomaly of the conductive apparatus not yet ascertained. Patients have informed me that the heavy concussions of a loaded truck passing over the pavement, or the rumbling of the elevated railway trains in motion, produce a painfully high-pitched sound, like a whistle. One can imagine that owing to the abnormal state of the conductive apparatus some sounds can make no other impact on the drum-head than is normally produced by the sound of whistling. What such a condition is we must leave for the physicists to determine.

This syphilitic affection of the ears has not been found to be a painful one, although the noises heard in the ears by the patients, together with the autophony usually present, render it very distressing. Most frequently patients designate these phenomena as "pain" or as "something throbbing or pulsating in the ear," etc., and a close examination is necessary in order to reach a differential diagnosis as regards the pain and the noise.

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[1] Vide "The Relations of the Conducting Mechanism of the Ear to Abnormal Hearing," Transactions of the American Otological Society, 1878.

As for the treatment, it must be confessed that the results so far obtained do not warrant a favourable prognosis. Should a case present itself when the aural attack was in its inception, the plan proposed by Wilde, and later by Roosa, to follow out the course of syphilographers under such circumstances, *i. e.*, attack such special manifestations of the disease with decided antisyphilitic medicines, might be attended with a greater degree of success, but inasmuch as the lesion is not ushered in with pain in the ears, the critical time when such treatment would be serviceable is usually lost before the aurist is consulted.

Conclusions.—1. Syphilitic affections of the ear inducing sudden deafness are of exceptional occurrence, and—

2. They would seem to be induced by a pre-existing hyperæmia in the ears, excited by sympathetic relationship or by an intercurrent attack of aural mucous catarrh.

3. The attacks are characterized by their sudden occurrence, and both ears are usually affected simultaneously, although the contrary sometimes takes place.

4. The deafness is always very great.

5. This syphilitic affection speedily causes a disarrangement of the integrity of the chain of ossicles, most likely at the malleo-incudal joint, probably in some instances at the stapedo-incudal joint, or both of these. The movements of the stapes in the oral window are also likely to be interfered with. The two first-mentioned conditions serve to explain the noises in the ears, and the autophony; the last-mentioned condition would increase the anomalies of hearing.

6. The affection does not depend, so far as we know, on anomalies of any portion of the labyrinth, although the latter of course is liable to invasions from syphilis with the nature of which we are as yet unfamiliar.

7. The disease is usually unattended by pain in the ears, it is non-purulent, and its incurability is a characteristic.

Addendum.—Before leaving the subject of syphilitic affections of the ear, it may not be out of place to allude to a remote cause of deafness which may arise from syphilitic inflammation of the throat, whereby the soft palate has become adherent to the posterior and lateral walls of the pharynx. In five of such cases which have come under my observation there was found to exist a mechanical obstruction of the pharyngeal mouths of the Eustachian tubes which was the cause of the deafness.